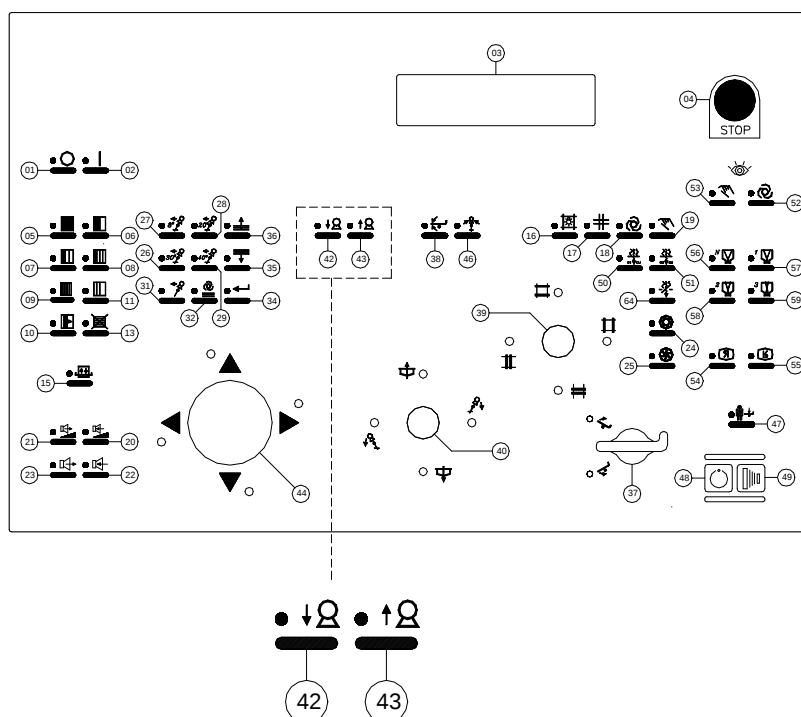


14 COLLIMATOR CORRETTIVE MAINTENANCE

14.1 FOREWORD

The **CLISIS** collimator is equipped with a software package that allows the service personnel to set various configurations and calibration parameters, that are stored into the collimator CPU serial eeprom. To run the service software is necessary to enter the unit maintenance mode carrying out the following procedure:

- 1 Switch on the unit and, while the leds of the control desk keyboard are flashing, press and hold at the same time buttons **42** and **43**.



until the following message appears on the alphanumeric display.

CLISIS SERVICE MODE

- 2 Release the 4 keys and wait for the console CPU to complete the self-test and the CAN bus initialization.

The maintenance mode can be abandoned in any moment pressing the **preparation** button.

WARNING:

In maintenance mode the collimator keyboard buttons have a different meaning. So be sure to press only the key specified in each single procedure.

14.2 OPTICAL SWITCHES REPLACEMENT

In order to correctly operate the collimator the optical switches that prevent the shutters to reach the complete end of the run must be correctly adjusted.

The suggested procedure is the following:

- 1 Remove the collimator covers.
- 2 Enter the maintenance routine as described in **17.1**.
- 3 By means of pushbuttons **3** and **4** drive the transverse shutters up to a closure of 2 mm, corresponding to 13 mm light on the tabletop.
- 4 Release screws **5.D** to free the metal bracket **7.D** of the transverse optical switch.
- 5 Position the metal bracket **7.D** in the way that the optical switch is activated only when the shutters are in this condition. The activation of the optical switch can be verified looking at the FFD display. If the transverse optical switch is not activated, the first digit of the display is **1**, while if the switch is activated the digit is **0**.
- 6 Lock screws **5.D** and verify that the optical switch is properly calibrated.
- 7 By means of pushbuttons **6** and **7** drive the longitudinal shutters up to a closure of 2 mm, corresponding to 13 mm light on the tabletop.
- 8 Release screws **4.D** to free the metal bracket **3.D** of the longitudinal optical switch.
- 9 Position the metal bracket **3.D** in the way that the optical switch is activated only when the shutters are in this condition. The activation of the optical switch can be verified looking at the FFD display. If the longitudinal optical switch is not activated, the second digit of the display is **1**, while if the switch is activated the digit is **0**.
- 10 Lock screws **4.D** and verify that the optical switch is properly calibrated.
- 11 By means of pushbuttons **8** and **9** drive the IRIS shutters up to a total closure, and go back just a little.
- 12 Release screw **14.D** to free the metal bracket **13.D** of the IRIS switch.
- 13 Position the metal bracket **13.D** in the way that the optical switch is activated only when the shutters are in this condition.
The activation of the optical switch can be verified looking at the FFD display.
If the IRIS optical switch is not activated, the third digit of the display is **1**, while if the switch is activated the digit is **0**.
- 14 Lock screw **14.D** and verify that the optical switch is properly calibrated.

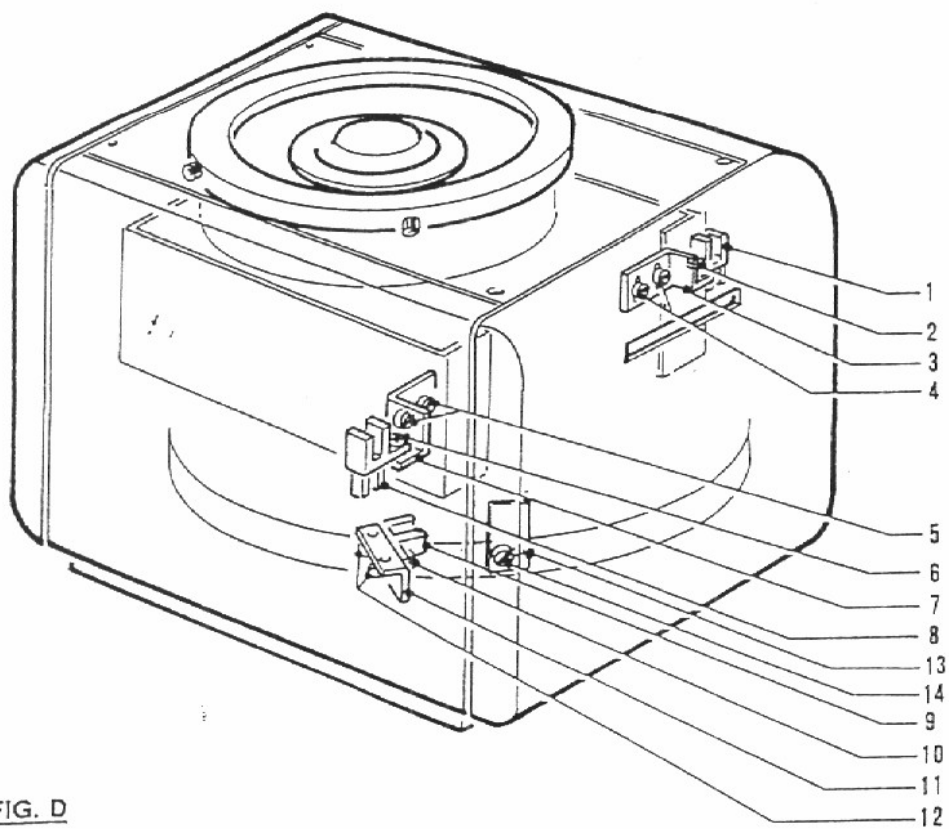
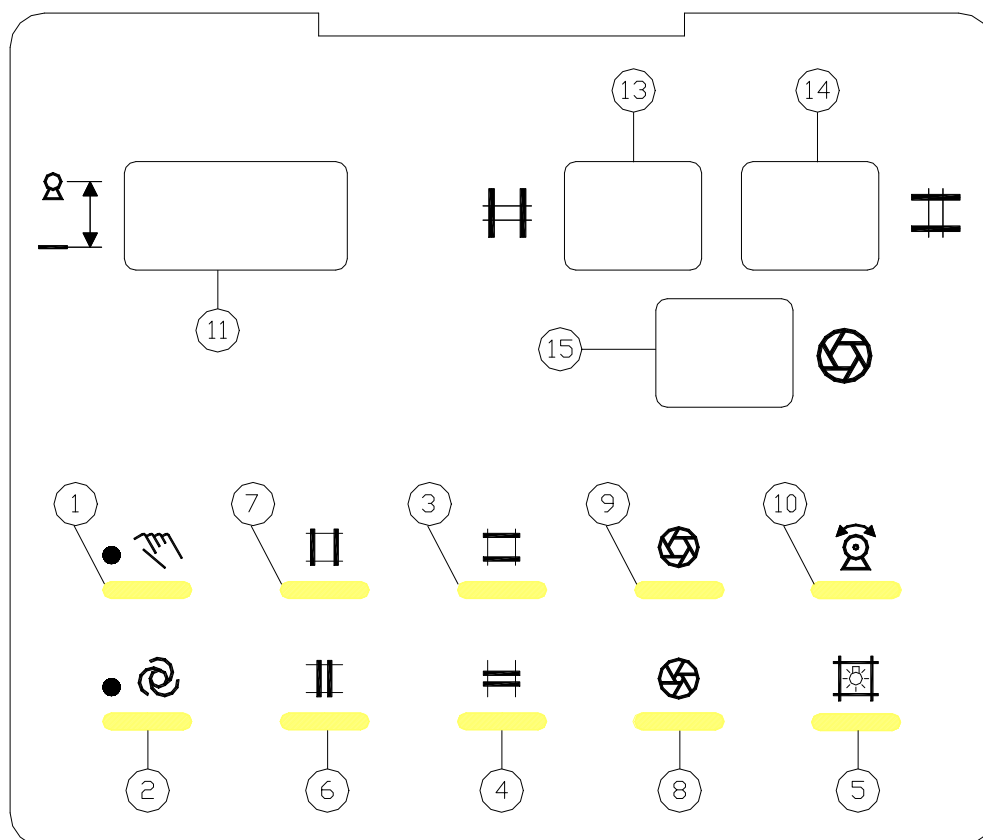


FIG. D



14.3 SIMULATION LAMP REPLACEMENT

THIS PROCEDURE MUST BE CARRIED OUT EACH TIME THE COLLIMATOR LAMP MUST BE ACCESSED FOR SERVICE OPERATION.

- 1 Loose screws **1** as shown in the following figure.
- 2 Remove the lamp cover **2** and spacer **3** as shown in the following figure.

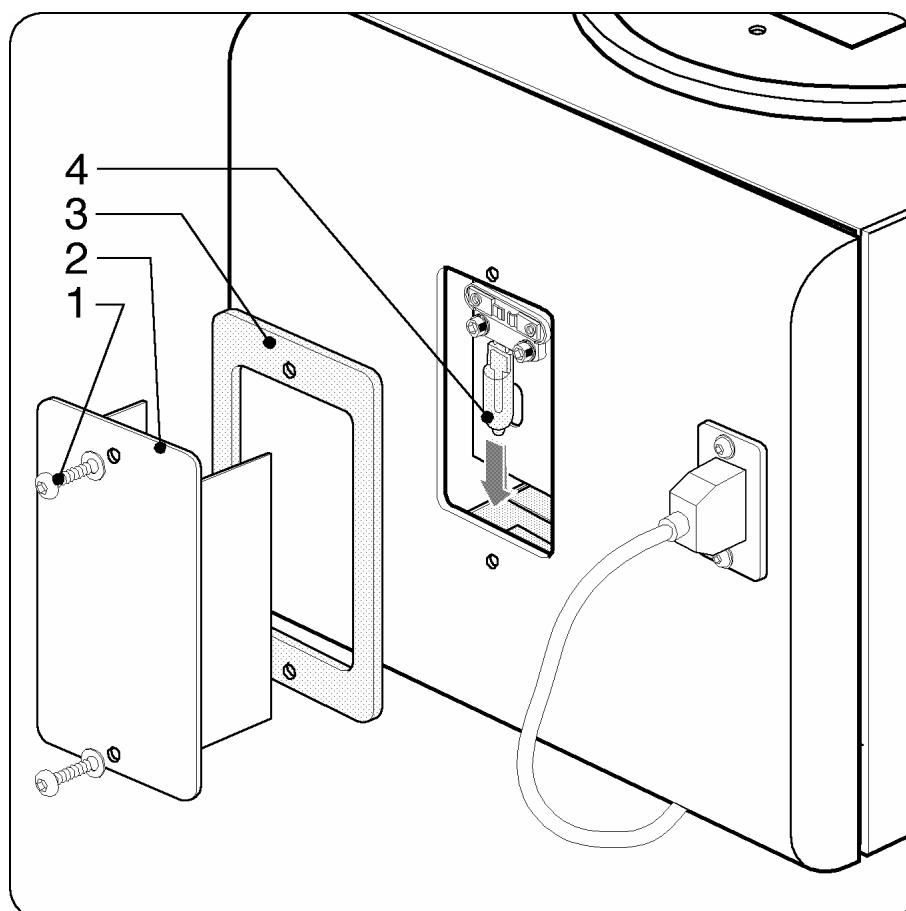
IMPORTANT WARNING:

BE CAREFUL ! THE LAMP COVER COULD BE HOT!

REPLACE THE LAMP WITH ANOTHER ONE OF THE SAME TYPE.

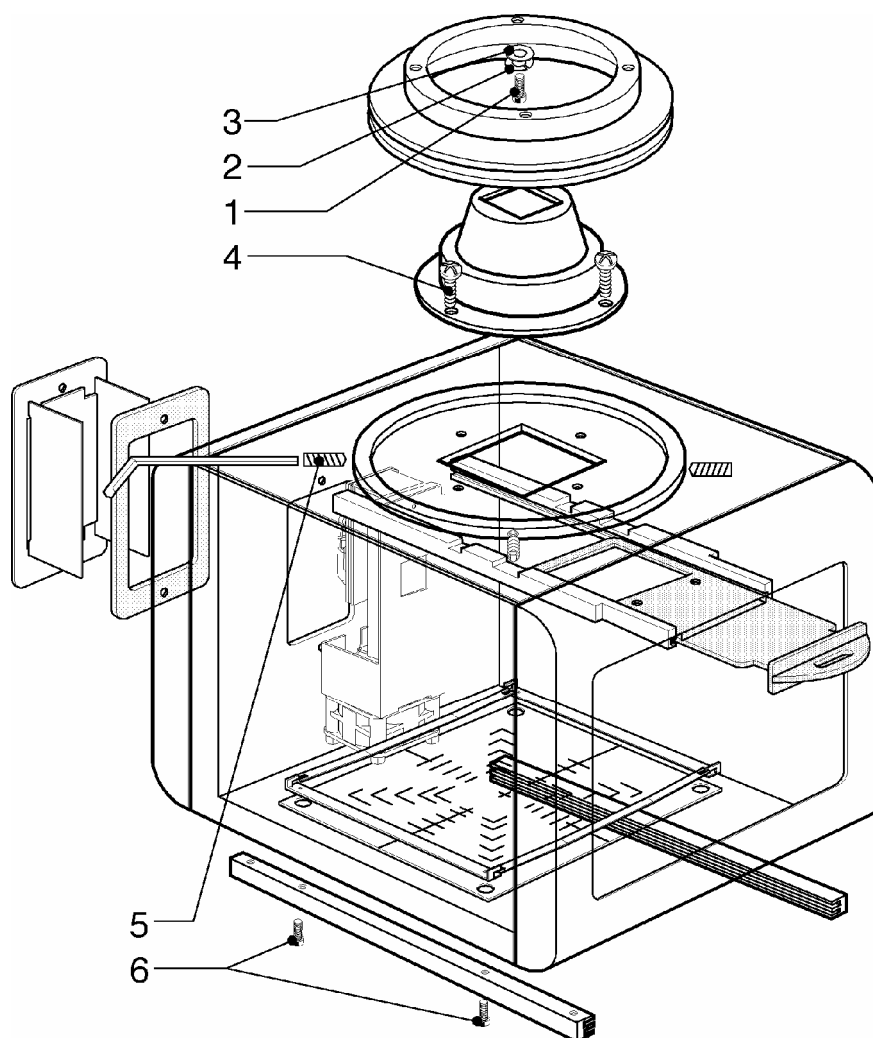
DO NOT TOUCH THE NEW LAMP WITH YOUR HANDS.

- 3 Replace lamp **4** by pulling it down.
- 5 Align light field and x-ray field following the procedures indicated in paragraph **9.2**
- 6 Mount back the covers following in the reverse order the instructions of this procedure.



14.4 COLLIMATOR CROSS REFERENCE ADJUSTMENT

- 1 Loose (not completely) screws **6**.
- 2 Adjust the mask as required.
- 3 Tight screws **6**.



14.5 COLLIMATOR INHERENT FILTRATION MODIFICATION

WARNING:

THE TUBE COLLIMATOR ASSEMBLY MUST COMPLY WITH IEC601-1-3 REGULATION. THAT IS TO SAY THE HVL MUST RESPECT THE FOLLOWING RULE:

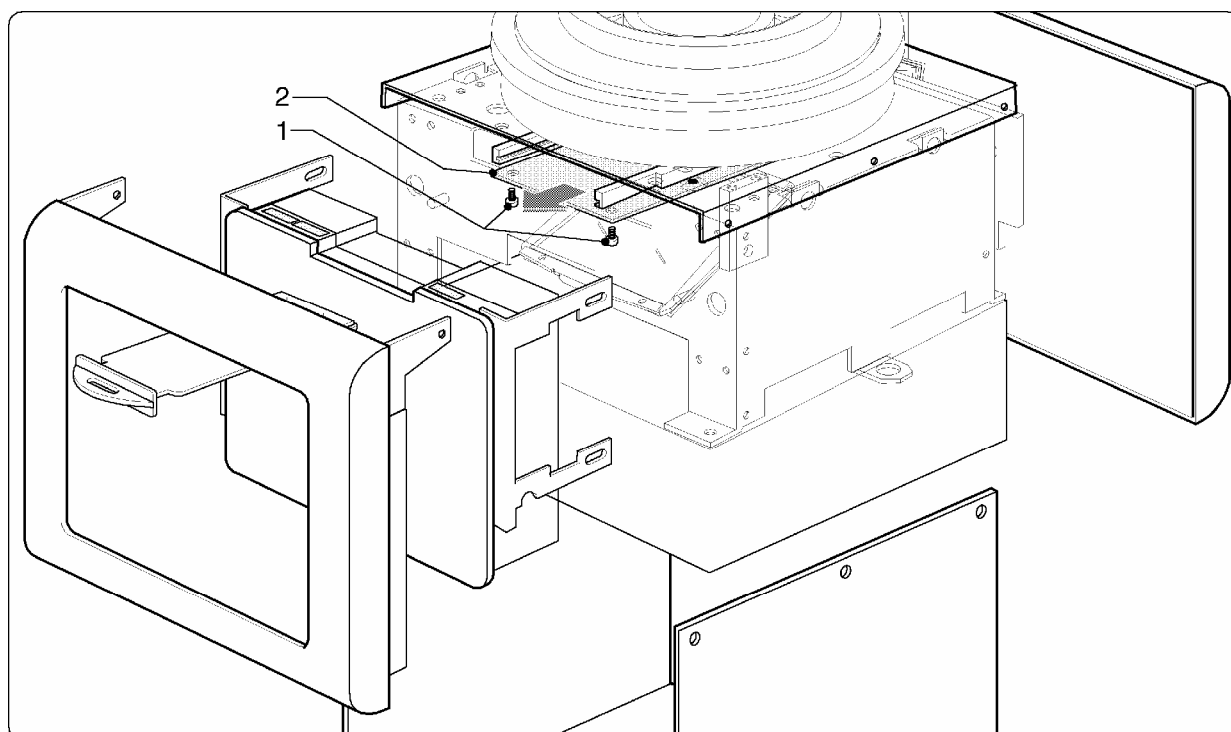
$$\text{HVL}(100\text{KV}) \geq 2.7 \text{ mmAl/Eq.}$$

IN CASE THE X-RAY TUBE INSTALLED ON THE SYSTEM IS NOT INCLUDED IN THE LIST OF SECTION 2.4, THE INSTALLER MUST CHECK THE HVL VALUE.

The **CLISIS** collimator is supplied with **1.7** mm Al inherent filtration in order to comply IEC 601.1.3 regulation when installed on tube housing with inherent filtration equal to **1.1** mm Al.

When installed on tube housing with a lower inherent filtration it is possible to insert inside the collimator an additional 0.5 mmAl/Eq filter, using the following procedure:

- Remove the collimator covers as shown in the following figure.
- Remove the collimator CPU with the keyboard assembly as shown in the following figure.
- Remove the fixation screws **1** and take out the filtration plate **2** by slipping it out of the front side.
- Correct the collimator filtration adding or removing the necessary number of 0.5 mm Al sheet. Additional sheets are delivered with the collimator. Lock the sheets using screws **1**.
- Re-assemble the collimator carrying out in the reverse order the previous instructions.



NOTE:

The installer examining the technical documentation of the x-ray tube (normally adding the X-ray tube inherent filtration to the Housing inherent filtration) must determine the value of the necessary additional filtration.

THE OPTIONAL BEAM HARDENING FILTERS MUST NOT BE USED TO MEET THE NECESSARY VALUE OF INHERENT FILTRATION.

WARNING:

AFTER THAT INHERENT FILTRATION HAS BEEN ENCREASED, STICK THE ADDED FILTRATION LABEL TO THE COLLIMATOR REAR SIDE NEAR THE COLLIMATOR ID PLATE.

Also, please register data into the following table:

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

TUBE HOUSING _____	S/N _____	INHERENT FILTRATION _____ mmAl/eq
COLLIMATOR _____	S/N _____	FILTRATION (mmAl/eq) INHERENT : _____ ADDITIONAL: _____

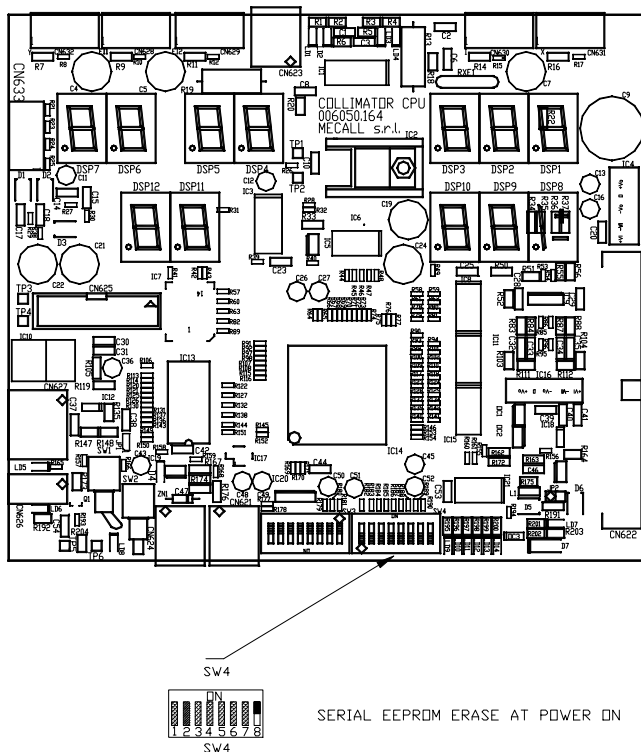
14.6. COLLIMATOR CALIBRATION

14.6.1 COLLIMATOR DEFAULT PARAMETERS LOADING

IMPORTANT NOTICE FOR THE INSTALLER

The loading of the default parameters has the effect to corrupt the previous calibration parameters stored into the collimator serial eeprom.
It is therefor necessary that the installer, once loaded the default calibration parameter, check for the proper calibration of the collimator and correct it, if necessary, as described in the following sections of this manual.

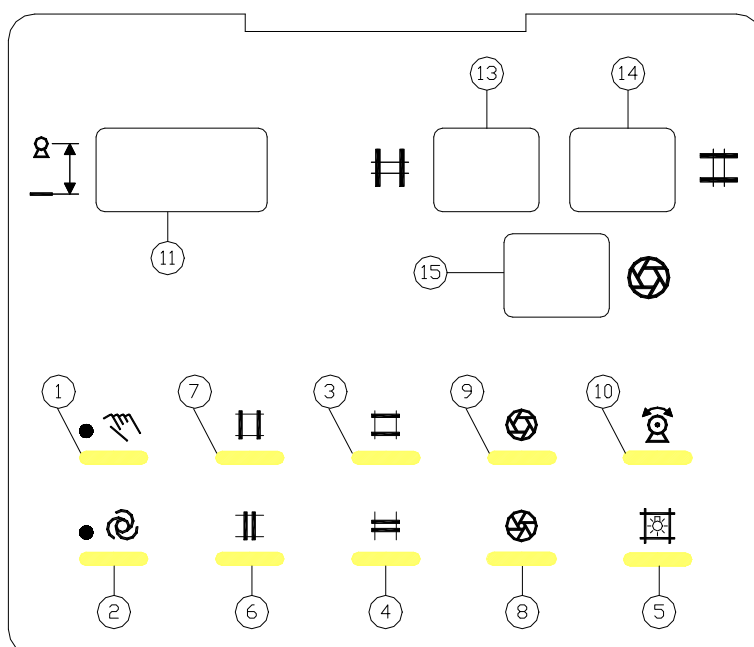
1. Remove the collimator front cover to access the CPU board from the bottom side.
2. Set **SW1.8** in ON position as shown in the following figure:



3. Switch the unit **ON**. The CPU will automatically load the default programming parameter into the serial eeprom.
4. Switch the unit **OFF**. Set **SW1.8** in **OFF** position.
5. Mount back the collimator front cover. Check for the proper calibration of the collimator and correct it, if necessary, as described in the following sections of this manual

14.6.2 COLLIMATOR LONGITUDINAL SHUTTERS ADJUSTMENT

- 1 Enter the CLISIS service mode as indicted in **section 14.1**.
- 2 Drive the X-RAY tube at the minimum FFD (105 cm).
- 3 Press and hold button **3** until the Transverse shutters are fully open.
Press and hold button **9** until the Iris is fully open.
- 4 Press button **1** on the collimator control panel repeatedly until the longitudinal display shows number **02**, to indicate that the calibration routine for the longitudinal shutters is selected.
- 5 Use buttons **6** and **7** to set the transverse field size to **18 cm**.
- 6 Press button **2** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 7 Use buttons **6** and **7** to set the transverse field size to **43 cm**.
- 8 Press button **5** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 9 Drive the X-RAY tube at the maximum FFD (150 cm).
- 10 Use buttons **6** and **7**, to set the transverse field size to **18 cm**.
- 11 Press button **10** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 12 Use button **7** to open the longitudinal shutters completely.
- 13 Proceed to the next calibration procedure if required.
- 14 Return to the main menu **00** pressing button **1**. Exit maintenance mode pressing the **preparation** button or switching the unit off.

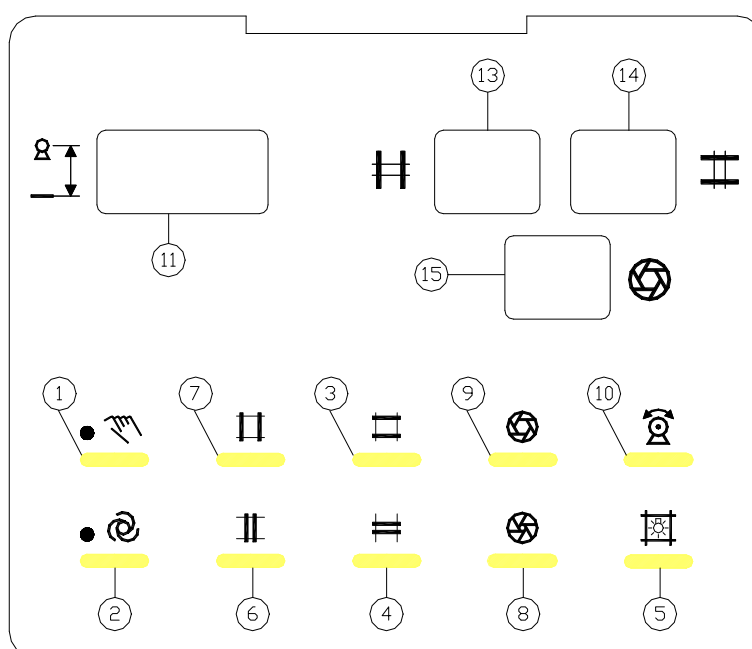


WARNING:

The dimensions used in the calibration must be considered as default ones.
If necessary it is possible to modify this data. However, at the minimum SID the dimensions must be increased or decreased of the same amount. No limitations exist for the 18 cm dimension at the maximum SID

14.6.3 COLLIMATOR LATERAL SHUTTERS ADJUSTMENT

- 1 Enter the CLISIS service mode as indicted in **section 14.1**.
- 2 Set the X-RAY tube at the minimum FFD (105 cm).
- 3 Press and hold button **3** until the Transverse shutters are fully open.
Press and hold button **9** until the Iris is fully open.
- 4 Press button **1** on the collimator control panel repeatedly until the longitudinal display shows number **02**, to indicate that the calibration routine for the longitudinal shutters is selected.
- 5 Use buttons **6** and **7** to set the transverse field size to **18 cm**.
- 6 Press button **2** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 7 Use buttons **6** and **7** to set the transverse field size to **43 cm**.
- 8 Press button **5** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 9 Set the X-RAY tube at the maximum FFD (150 cm).
- 10 Use buttons **6** and **7**, to set the transverse field size to **18 cm**.
- 11 Press button **10** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 12 Use button **7** to open the longitudinal shutters completely.
- 13 Proceed to the next calibration procedure if required.
- 14 Return to the main menu **00** pressing button **1**. Exit maintenance mode pressing the **preparation** button or switching the unit off.



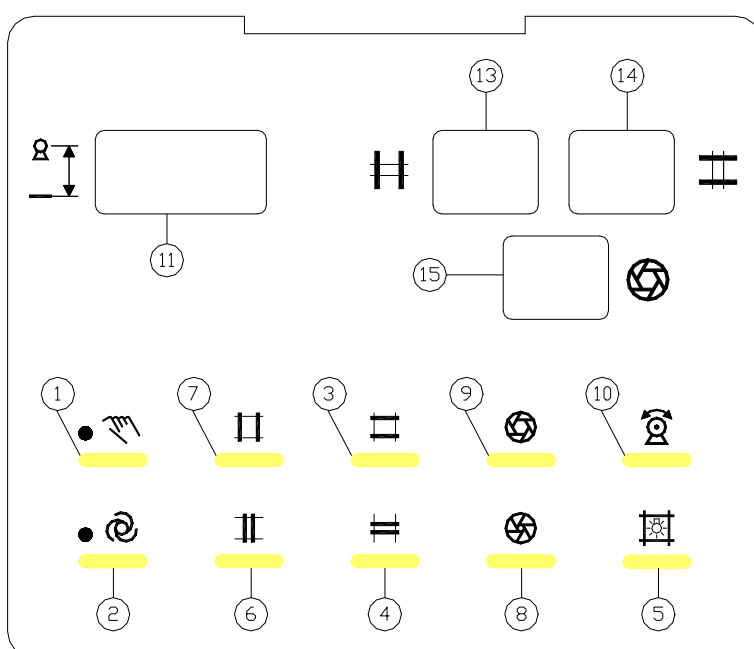
WARNING:

The dimensions used in the calibration must be considered as default ones.

If necessary it is possible to modify this data. However, at the minimum SID the dimensions must be increased or decreased of the same amount. No limitations exist for the 18 cm dimension at the maximum SID

14.6.4 COLLIMATOR IRIS SHUTTERS ADJUSTMENT

- 1 Enter the CLISIS service mode as indicted in **section 14.1**.
- 2 Set the X-RAY tube at the minimum FFD (105 cm).
- 3 Press and hold button **3** until the Transverse shutters are fully open.
Press and hold button **7** until the longitudinal shutters are fully open.
- 4 Press button **1** on the collimator control panel repeatedly until the longitudinal display shows number **03**, to indicate that the calibration routine for the iris is selected.
- 5 Use buttons **8** and **9** to set the iris to a diameter of **18 cm**.
- 6 Press button **2** to record this position in the eeprom of the collimator CPU. The iris will close and re-open to the set dimension. Check that the opening is correct.
- 7 Use buttons **8** and **9** to set the iris to a diameter of **43 cm**.
- 8 Press button **5** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 9 Set the X-RAY tube at the maximum FFD (150 cm).
- 10 Use buttons **8** and **9** to set iris to a diameter of **18 cm**.
- 11 Press button **10** to record this position in the eeprom of the collimator CPU. The shutters will close and re-open to the set dimension. Check that the opening is correct.
- 12 Use button **9** to open the iris completely.
- 13 Proceed to the next calibration procedure if required.
- 14 Return to the main menu **00** pressing button **1**. Exit maintenance mode pressing the **preparation** button or switching the unit off.



WARNING:

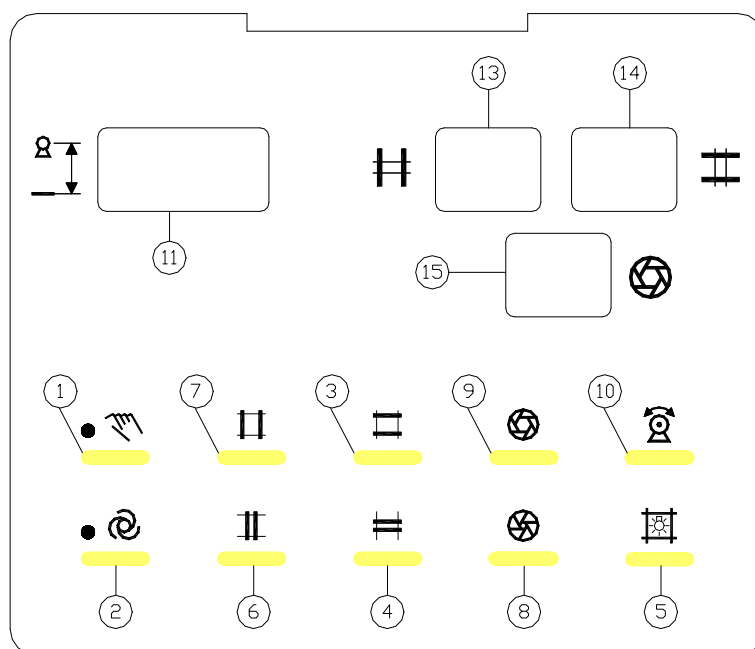
The dimensions used in the calibration must be considered as default ones.

If necessary it is possible to modify this data. However, at the minimum SID the dimensions must be increased or decreased of the same amount. No limitations exist for the 18 cm dimension at the maximum SID

14.6.5 COLLIMATOR SHUTTERS MAXIMUM OPENING SETTING

This procedure is for entering software limits for the maximum opening of the collimator shutters.

- 1 Enter the CLISIS service mode as indicted in **section 14.1**.
- 2 Press button **1** on the collimator control panel repeatedly until the longitudinal display shows number **04**, to indicate that the maximum opening calibration routine is selected.
- 3 Use buttons **3, 7** and **9**, to completely open all collimator shutters.
- 4 Press button **10**; the transverse shutters will close and then return to the previous position.
- 5 Press button **5**; the longitudinal shutters will close and then return to the previous position.
- 6 Press button **2**; the iris will close and then return to the previous position.
- 7 Proceed to the next calibration procedure if required.
- 8 Return to the main menu **00** pressing button **1** and exit maintenance mode pressing the **preparation** button or switching the unit off.



14.6.6 I.I. FIELDS DIMENSION COMPENSATION

Using this calibration routine it is possible, after the collimator full calibration, to adapt the theoretical I.I. fields size to the real useful fields of the installed I.I.

WARNING:

Even if it is necessary to modify the size of the I.I. fields, this procedure must be carried out in order to record the standard calibration values into the CPU eeprom.

- 1 Enter the CLISIS service mode as indicted in **section 14.1**.
- 2 Press button **1** on the collimator control panel repeatedly until the longitudinal display shows number **06**, to indicate that the I.I. field size compensation routine is selected.
- 3 Press button **3**. The collimator will set the iris to the Nominal full size of the I.I.
- 4 Using buttons **8** and **9** set the exposure area to the desired size:
 - a Each time button **8** is pressed, the diameter will be reduced by 1 cm.
 - b Each time button **9** is pressed, the diameter will be increased by 1 cm.
 - c The exposure field size can never exceed the nominal field size.
- 5 Press button **10** to store this value to the CPU eeprom.
- 6 Press button **4**. The collimator will set the iris to the Nominal size of **MAG1**.
- 7 Using buttons **8** and **9** set the exposure area to the desired size. Items a, b, and c of step **4** apply.
- 8 Press button **10** to store this value to the CPU eeprom.
- 9 Press button **7**. The collimator will set the iris to the Nominal size of **MAG2**.
- 10 Using buttons **8** and **9** set the exposure area to the desired size. Items a, b, and c of step **4** apply.
- 11 Press button **10** to store this value to the CPU eeprom.
- 12 Press button **6**. The collimator will set the iris to the Nominal size of **MAG3**.
- 13 Using buttons **8** and **9** set the exposure area to the desired size. Items a, b, and c of step **4** apply.
- 14 Press button **10** to store this value to the CPU eeprom.
- 15 Return to the main menu **00** pressing button **1** and exit maintenance mode pressing the **preparation** button or switching the unit off.

WARNING:

Each time that the operator presses buttons 3, 4, 6, or 7 the nominal I.I. field diameter will be shown. If the operator does not store new calibration data pressing button 10, the old calibration data will remain valid.

